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ABSTRACT

This chapter of "Principles of School Business Management" provides an overview of the role of computers--and microcomputers in particular--in the school business management process. The chapter opens with a background discussion of the management information system (MIS) concept in general. This topic is examined in terms of the characteristics of and interrelationships among three critical concepts: management, information, and systems. The chapter then turns to the impact of the microcomputer-based system, the peripheral devices, the characteristics and types of software available, and typical program features. The chapter next addresses human factors involved in implementing MIS. These factors include (1) overcoming resistance to implementation; (2) providing training for efficient use of MIS; and (3) managing the MIS operation. Specific applications of a micromputer-based MIS are the chapter's last major topic. A chart diagrams the relationships among typical uses in a school district. Seven sample reports that can be generated through the use of such a system are displayed. (PGD)

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Management Information Systems in Educational Organizations

Frederick L. Dembowski

This chapter is intended to give the reader an overview of the uses of the computer in school business management. The focus is on the role the computer (particularly the microcomputer) plays in the management process, rather than on the computer technology itself (although a basic understanding of the components and terminology is helpful). The reason for this emphasis is that the computer industry is progressing so rapidly in both technological advances and applications that by the time a chapter on computer use is written and published, it may be obsolete.

This chapter will begin with a discussion of management information systems (MIS) to provide a general framework and then branch into discussions of specific computer topics. Many believe that an MIS is the computerization of clerical work. Others think it is an ultra-sophisticated computer system that will provide answers and decisions for complex problems to managers at the push of a few buttons. Both of these beliefs are misguided. The concept of MIS can be understood most readily by examining the three words management, information and systems separately.

Management Information Systems[1]

Management consists of the activities carried out by managers. They plan, organize and control the major activities of the organization and initiate actions. The practice of management consists of the artful application of scientific principles to problem solving in order to select courses of action that optimize the utilization of scarce resources in achieving the desired objective. Because decision making plays such a major role in all of the functions of management, the MIS becomes a facilitating system for developing decisions in planning, organizing, controlling and initiating courses of action. This yields the purpose of the MIS.

Information and Data

Information is often confused with data, but there is an important distinction between the two concepts. Data are facts and figures not used in a decision process. Files, records and reports not under immediate consideration are examples. Infor-

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mation, on the other hand, consists of classified and interpreted data used for decision making.

Data has its own life cycle which must be taken into account in the design, development and operation of an MIS. The manager needs to know how the data are generated (Where do they come from? What are the source documents?), what manipulation or processing of the data needs to be carried out (Is it in the form that is needed? Is it to be added to other data sets?), and do the data need to be transmitted to another site, stored or retrieved. The steps in the life cycle of data upon generation are as follows:

Storage. The "birth" of data is the result of some action that is either observed or recorded in the environment surrounding the organization or within the organization itself. Before data may be manipulated or utilized, they must first be recorded or stored in the human mind or in an electrical or mechanical device.

Conversion. Data are usually converted from storage to some more convenient form, such as documents, reports or computer input.

Transportation. Data are constantly being transported from source to storage to processing to user to storage, and so on.

Reproduction. Data are often not stored in a form that is readily interpretable. Storage on tape, cards, in files or on disks often must be reproduced in different form. Many more copies may be required than exist in storage. Backup data which are often required by law in case of loss of original data, is generally desirable.

Classification. Data are often accumulated at random and must be sorted to be useful. Even data that have been sorted and classified may be needed in a different form. This leads to data base management systems within the MIS.

Synthesis. Aggregation of many pieces of data to structure a meaningful whole or complete report is often required.

Manipulation. Quantitative data must often be operated upon by adding, subtracting and so on, to change their form or develop their meeting through formulas or equations. Statistical methods are often used to define the limits and parameters of the data sheet.

Utilization. After the data are put into a suitable form, they can be retrieved as information for the decision maker, when needed.

Evaluation. The value of data depends on their accuracy, reliability and time reference as well as on the needs of potential users. There is an economic aspect of the cost of storage versus the value of current data and future data that could be stored. Data files should be continually monitored to eliminate useless and low-priority data.

Destruction. Data records may be stored again or destroyed following their evaluation or use. Destruction of data records may occur on a purely routine basis following one-time use or in the review of old records. Destruction is, of course, the end of the life cycle of data.

While the development, design and operation of the MIS must take into account all of these processing steps, storage and retrieval require special attention.

Systems

A system is a set of two or more elements joined together to attain a common objective. A system may be further delimited into sub-systems which work more effectively together as one system, than if they were working separately. As will be

described in a later section, a computer consists of many components working in harmony which is why it is often called a computer system.

Management information systems or MIS is the means for connecting the operating systems in an organization by the exchange of information. The computer is only one component in the MIS. The human element is another important component in the MIS. For example, the manager must take an active role in the design of the MIS as the principal user, and all the users of the MIS must be accustomed to accept the MIS and trained in its efficient use.

With the development of the concept of the MIS, three changes must also take place in well-managed organizations:

1. Management must become systems-oriented and more sophisticated in management techniques.

2. Information must be planned for and made available to managers as needed.

3. A system of information must be developed which ties planning and then control by managers to operational systems of implementation.

The management information system collects, analyzes, stores and displays data about such things as supplies, equipment and personnel in the organization to managerial decision makers at all levels of management. The MIS raises management skills from the level of intuitive guesswork to the level of systems information, sophisticated data processing and systems problem solving. Thus, it is a powerful method for aiding managers in solving problems and making decisions.

The overall job of a manager is to create within the organization the environment which will facilitate the accomplishment of its objectives. In doing this, the manager plans the work of the subordinates as well as his or her own activity, selects and trains the subordinates by staffing the operations, organizes the work and task relationships, directs the work and controls results by measuring performance against the plan. Many managers make the mistake of believing that an MIS can be designed and made operational without an adequate management system. Needless to say, one is dependent on the other. Without the firm foundation of a good management system, the MIS will not provide the manager with the information needed in the form, place and time that is needed in order to perform the job according to the specifications of the management system.

How does a computer fit into this scheme? As previously suggested, there are several prerequisites for a modern, effective computer based management information system. The first is the development of a management system of the organizational arrangements, the structure and procedures for adequate planning and control and the other management functions. Second, there must exist data and information about the organization's goals, resources, policies, operations, plans and performance against the plans. Third, in order to process these data, it is necessary to have appropriate equipment that will: a) provide the capability for rapid retrieval of stored data; b) process this information economically and at high speed; and c) enter information into the system, retrieve and display it. These three activities are performed by the computer and related hardware. A final prerequisite to an effective computer-based MIS is information management, an organization for designing, maintaining and managing the required systems and procedures.

This function is performed in part by software and in part by the management of the computer system.

A computerized information system is composed of five basic processes: 1) entering data into the system; 2) processing data (rearranging input data and processing files); 3) maintaining files and records; 4) developing procedures that tell what data are needed; when and where they are obtained; how they are used, as well as providing instructions for the processor to follow; and 5) preparing report output. These basic components form the basis of a computer-based MIS.

MIS and the Microcomputer

Since the introduction of the first commercially available microcomputer in 1978, microprocessor technology and related advances in other aspects of computer hardware have reduced the distinction between large "mainframe" computers and desktop microcomputers. As this chapter is being written, there are microcomputers with up to 100 megabytes of hard disk storage, and up to 5 megabytes of RAM. This capability which would have cost over $1 million in 1970, today costs approximately $10,000—well within the financial range of all school districts.

Hardware Components of a Microcomputer-Based MIS

A microcomputer system consists of three primary components: input devices, the Central Processing Unit and output devices. Each of these components, in turn, consist of many sub-components. At the heart of the entire system is the microprocessor itself. The microprocessor or "chip" is about the size of a thumbnail although slightly thicker. On the chips are etched a complex series of integrated circuits that are essentially nothing more than electronic switches. In each switch, the electricity is either "on" or "off." The entire microcomputer system operates by controlling the flow of electrical impulses through these switches in a prescribed manner.

Each small electrical impulse is called a bit. A bit is either a "0" signifying the presence of electrical energy, or a "1" signifying the absence. Four bits are called a byte. The microprocessor processes the bits and bytes of information in groups called words. Words usually consist of 8 bits, 16 bits or 32 bits, although some companies use different length words. The micros that handle only 8 bit words are called 8 bit machines. Most of the micros today are 8 bit, 16 bit and 32 bit micros.

Why different size words? A microprocessor that uses 16 bit words is not only twice as fast at processing information than the 8 bit machines, but also handles twice as much information. Evaluating a microprocessor is somewhat like evaluating a truck; you must determine both how fast it goes and how much it can carry in one load.

Regardless of the word size used by a micro, the coding arrangement of the bits into words is standardized. The vast majority of micros use the American Standard Code for Information Interchange, (ASCII), (pronounced "as-key"). The ASCII code consists of 256 combinations of bits, with each combination representing a unique symbol. For example, the arrangement of a 8 bits in "01000001" represents an "A" while "00111000" represents an "8." Each character on the micro-

computer keyboard as well as a number of specific microcomputer commands such as "advance cursor" or "backspace" is assigned to one of the 256 ASCII codes. The microcomputer receives all of its processing instructions and data through the use of these coded words.

The microprocessor in the micro consists of several parts. The Central Processing Unit (CPU) performs all the logical and arithmetic functions of the computer. Essentially, the CPU performs all the functions of the micro by adding or subtracting the bits stored in special locations called registers. The registers have a very limited storage capacity, so the CPU must usually obtain the information it processes from the "memory" of the micro. Although some micro processors have this memory on the same chip as the CPU (such as the "old" 4 bit processors found in most electronic games), most 8, 16 and 32 bit micros have their memory stored on different chips, with wires (called busses) connecting the various chips to the CPU chip. This electronic circuitry is found on a circuit board commonly called the "Mother Board." There are five basic kinds of busses. Address lines define the location of data or instructions to be used next by the CPU. Data lines carry the data to and from the CPU. Timing and Control lines control the timing of the flow of the electrical signals. Clock lines set the timing of the system, and power lines provide the electrical power for the micro system to operate. In order to perform its assigned functions, the CPU may have to request the processing instruction information from one chip, the data to be processed from another and then store the results in another chip. However, the micro does all this processing in a few nanoseconds. A nanosecond is one billionth of a second.

All micros have preset operating instructions built into them. These instructions are loctaed in the ROM or Read Only Memory. The ROM usually contains between 5 and 50 kilobytes of information. A kilobyte contains 1,024 bytes. Each kilobyte is abbreviated by "K." Thus, a microcomputer with 8K ROM could be able to contain 8,192 bytes of information. The ROM contains the instructions necessary for the micro to begin when you enter your instructions (i.e., clear all registers, power up, load the operating system, start the cursor blinking and so on.) Most ROMs are pre-programmed by the manufacturer and may not be changed by the user. The ROM is not volatile in that it is not erased when the power to the micro is shut off. However, programmable ROMs (PROMs) and erasable programmable ROMs (EPROMs) are available on some micros.

The portion of memory that is used to store the programs and data entered by the user is called the RAM or Random Access Memory. This is also referred to as main memory, core memory or main storage. Data may move to and from the RAM and CPU. Being volatile, all data in the RAM are lost when the power is shut off. Most RAMs are based on units of 64K, with the most common configurations being 48K, 64K, 128K, 256K, 512K, and 640K. A 64K machine is actually capable of storing 65,536 bytes of information. This may seem like a lot of information storage capacity, but it is utilized very quickly. It takes 1 or 2 bytes to store just one letter or number. Most users seem to be able to outgrow their RAM very quickly.

Generally, the more RAM a micro has available for use, the more expensive the machine. RAM may also be purchased at a later date for installation into the micro. For example, certain micros may be purchased with 256K RAM and upgraded to a 512K RAM through the addition of an "expansion board." Some micros can be expanded even past their original computing capability by purchasing special

equipment from hardware vendors specializing in modifying basic equipment. Most of the best selling micros have these options available because of high demand for them. Thus, an important feature in microcomputers is the number of expansion slots available on the mother board.

Some microcomputers have limited or no expansion slots available to the user because they are used for the installation of standard equipment. For example, certain micros have four expansion slots—one for the disk drive controller board, one for the color graphics board and a third for a printer board that supplies a parallel port for the printer. This leaves the user with only one expansion slot upgrading purposes. In contrast, a comparable micro may be equipped with a parallel port and disk drive controller built into the mother board (the main circuitry board), plus eight expansion slots. Thus, the user has a large number of expansion slots available for future upgrading.

Expansion Slots and Peripheral Devices

As discussed above the typical microcomputer has two storage areas, or memories, the ROM and the RAM. Both the ROM and RAM are limited in storage capacity. As a result, in order to utilize its full capability, external storage space is required in a microcomputer system. These external storage devices (also called auxiliary storage or mass storage) interact directly with the CPU and are used to transmit data to and from the CPU for processing. Currently there are at least four different classes of external storage devices: the data cassette recorder, the "stringy floppy," the "floppy" diskette and the hard disk.

The data cassette recorder is typically a modified version of the standard audio cassette tape recorder. The data cassette is connected to the CPU through a cassette port. Data are stored on a magnetic tape in audio tones, with one frequency representing a "0" bit, and another frequency representing a "1" bit of data. The data cassette transmits this audio signal to the CPU which then converts it into the digital electronic form required by the CPU. This audio to digital transformation is conducted by a component of the CPU called the I/O Processor.

The primary advantage of the data cassette recorder is that it is relatively inexpensive compared to the other forms of external storage. Cassette recorders typically cost between $40 and $80, with the magnetic tapes costing about $2. The cassette recorder is not without its disadvantages. First, it is relatively slow, greatly increasing the input/output time required to enter programs and data into the micro. Some micros, however, are capable of reading data from cassettes at varying speeds. The speed of reading data is called the baud. A baud is 1 data character per second. A standard transmission rate for cassette recorders is 30 baud. Second, it is relatively unreliable in that it has a higher probability of data transmission and storage errors than other storage devices. Third, it has limited storage capacity. A thirty minute magnetic tape is capable of storing only about 32K of data. Finally, magnetic recorders access and transmit data sequentially, (i.e., in a row, one after another). This creates the problem of finding the starting point of the data before transmission which can be time consuming.

As the price of the other external storage devices has fallen, the role of the cassette storage device has been reduced to the point where it is used as a storage device for only very small home computers, or for very large microcomputers. On large micros, with a hard disk drive, the cassette is used as an inexpensive data backup system. Typically, the backup systems, which cost from $1,000 to $3,000

and are capable of storing up to 50 megabytes of data from a hard disk, are used in MIS for business.

Besides the cassette recorder for storing data, some magnetic tape recorders store data directly in the form of a digital signal that is readable by the CPU. Although these digital storage devices are faster and more reliable than audio recorders, they are also more expensive. The wheel-to-wheel tape drives seen with main frame computers are of this type.

Another relatively low-cost data recorder is called the "stringy floppy." A stringy floppy is a device that stores data directly as a digital signal on a continuous loop of magnetic tape. One stringy floppy that is currently being marketed can store up to 70K, transfers data at 7200 baud and is relatively inexpensive. This technology is rapidly becoming obsolete as the cost of floppy and hard disk storage devices drop.

Magnetic disks remedy many of the deficiencies inherent in tape storage devices. They are typically much faster in operation partly because they utilize random access techniques in retrieving data. The disk drive goes directly to the location of the beginning of a data file and begins transmitting the data to the CPU as a digital signal. It does this by utilizing a disk directory (usually called the "FAT" or File Allocation Table) that tells the I/O Processor exactly where the desired program or data file lies on the disk. The access time for disk drives is usually measured in thousandths of a second. Disk drives also store data in digital form that is directly readable by the CPU. Disk drives are also faster mechanically than tape drives.

There are two types of disk drives: floppy disks, also known as diskettes, and hard disk drives. The floppy disk usually comes in two sizes, 5 1/2 and 8 inches in diameter, with a 3 inch size only now becoming popular. They are permanently enclosed in a paper or plastic covering that has "windows" in it through which the heads of the disk drives come in contact with the magnetic surface of the diskette. The storage capability of diskettes depends on whether the disk is single, double or quad density and single or double sided. For example, a single-density, single-sided 5 1/2 inch diskette can store approximately 80K to 120K, whereas a double-sided, double-density diskette can store up to 360K. Eight-inch floppy diskettes are capable of holding up to 1 million bytes (also known as 1 megabyte and referred to as 1M).

The storage capacity of diskettes is continually being increased through technological breakthroughs. For example, the "bubble" technology in which the writing surface of the disk consists of small magnetic bubbles instead of the current flat surface of magnetic material will greatly increase the surface area for writing data, thereby yielding a greater storage capacity. A serious problem arises as a result of the diversity of types of disk drives: not all disks can be read by all disk drives even when formatted on the same type of microcomputer. For example, a disk that is formatted on a particular brand of microcomputer with double-sided, double-density disk drives will not run on the same brand with single sided disk drives. (The converse is possible however.)

Hard disks are made of aluminum and are covered with a magnetic coating. They operate much faster than floppy disks and can store more information than floppy disks because the disk head that reads the information glides over the top of the disk without actually touching its surface. At the same time, machine tolerances of the hard disk drive are very fine; a single speck of dust between the read

head of the disk drive and the surface of the disk can cause great damage. Hard disk drives, which are housed in special containers, are rarely exposed to the atmosphere except during maintenance. The user, however, has the option in some brands of hard disk drives to remove the hard disks. Hard disk drives currently can store from 1M to 100M of information.

The cost of disk drives varies in direct proportion to the capability of the drive. Floppy disk drives cost anywhere from $250 to $1,000 depending upon whether they are single or double-density, single or double-sided, or include a disk operating system software package. Hard disks also vary depending on the various capabilities. For example, a 360K, 40 track, double-sided, double-density disk drive with operating system currently costs about $300, while a hard drive system with 10M of fixed hard disk complete with all controllers, adapters, cables and so on costs approximately $1,000.

In addition to the processing and exchange of information between the CPU and the external storage devices, the micro also must exchange information with the user. There are two classes of peripheral devices that exchange information between the micro and the user: input devices and output devices. These devices are very important to the overall operation of the microcomputer system because the input/output time (I/O time) varies greatly depending on the capability of the I/O devices. Quite often, I/O time exceeds the processing time required by the micro, and the CPU has to wait until a particular input or output operation is completed before it can continue to process.

There are a wide variety of input devices that interface the user with the micro. The typewriter-like "qwerty" keyboard is the most common input device. Each time the user strikes a key, an electronic pulse is sent to the I/O processor of the micro which is converted into a digital signal usable by the CPU. Usually, these signals are stored temporarily in the RAM, and then processed on receipt of a unique user command, such as "RUN" in BASIC. Keyboards vary in characteristics. Some are flat, touch sensitive surfaces, while others are like typewriter keyboards with the addition of special command keys such as *BREAK, ESCAPE* and *CLEAR*. Two pitfalls in keyboards are the size of the keys themselves (some keys are too small for accurate fingering) and touch sensitivity (some keystrokes produce double letters). In addition, many keyboards have a special numeric pad similar to the keypad of an adding machine for quicker input of data.

Some keyboards are self-contained and are connected to the micro by means of a cable, while others are located in a unit containing other components of the microcomputer system. Certain models have the keyboard and the CPU in the same unit, some are in a self-contained unit containing the CPU, keyboard, video monitor and disk drives, still others have the components separate but connected to the CPU by cables.

There are a number of other types of input devices. Optical scanning devices, such as optical character readers and mark sense readers, are used to convert electrically detectable marks on paper into electronic signals for processing. Optical scan input devices allow for high volume data transfers and greatly speed up the data input process. Light pens enable the user to draw or write directly onto the surface of the video monitor. The image on the screen is then transformed into electronic signals to the CPU and either processed or stored for later output. Game paddles enable users to manipulate images on a video screen very quickly. Another common type of input device is the "mouse." A mouse is used to control the

movement of the cursor on the monitor screen, and a pushbutton is used to indicate when particular actions are to be initiated.

A modem (modulator/demodulator) is another form of input device. Using the telephone communications system to carry audio signals over great distances, the modem enables users and other computers to communicate with the micro. This capability gives rise to distributive data processing in which data are entered into the data processing system via a remote terminal and sent to the host computer for processing. The latter then sends the processed information back to the originating terminal (often a micro) for retrieval. Modems also facilitate the formation of microcomputer networks (although they are not the only way to form networks). In a network, the microcomputers are able to share common external storage devices, including a large hard disk drive, a large CPU and other peripheral devices such as printers and color monitors. Networks will grow in importance in future years, with micros playing a central role as "smart terminals" in distributive data processing systems, in networks and in microcomputer based telecommunications systems.

There are a number of output devices in a microcomputer system which allow communication between the micro and the user. The video screen allows the user to see the information. The many different characteristics of video screens have a significant effect on the operation of the microcomputer system. Some video monitors produce color images (either RGB or composite), while others are in black and white. Some monitors are single color (monochrome) green or amber, colors which have been demonstrated to lessen eye fatigue. The resolution of the screens also vary. High resolution screens (such as RGB color monitors) allow for a greater number of images (known as pixels) per square inch of the screen. The resulting clear and sharp pictures are especially important for computer graphics. Some computers are capable of displaying only block character pixels on their video screen. These computers do not have the graphics capability of the high resolution video screens. Generally, the color video screens which have about the same resolution as a color television are higher in resolution than the black and white screens.

The printer allows the user to receive written output on a piece of paper. Printers also vary greatly in quality and features. Some printers come with a keyboard so that they can both send and receive information, but the typical printer can only receive. Printers produce character images on paper, thermally or electrostatically or by means of a dot matrix, daisy wheel, ink jet or laser. A dot matrix printer produces characters by arranging dots in predetermined order on the paper. Again, there is a question of resolution, with more dots per square inch producing a more desirable result. Some dot matrix printers produce letter quality print and some offer a variety of print fonts and other printing capabilities. Others have limited applications and deficiencies including an inability to print characters "below the line" (resulting in a "g" looking like a "9"), underline, or produce superscripts and subscripts. Some dot matrix printers are capable of double striking all characters producing boldly printed letters and "shadow" letters. The latter is produced by printing slightly displaced (i.e., to the right by .001 inch) dots over the first set of dots. A versatile dot matrix printer should have all these capabilities.

Daisy wheel printers use fixed type on a "daisy wheel" such as used in an IBM Selectric Typewriter. These printers produce letter quality print and are very fast, although the speed of the daisy wheel printers also varies greatly among brands.

They are versatile to the extent that the daisy wheel print font can be changed. High quality daisy wheel printers should also be able to print in ten or twelve picas per inch or proportionally, as well as underline and use superscripts and subscripts.

Ink jet and laser printers are very high speed printers that produce letter quality print. These printers are usually found in high volume data processing operations. Thermal and electrostatic printers use lower quality printing technologies which have been surpassed by recent printer developments.

The paper format which is used by a printer is very important. Printer paper comes in rolls, continuous pin feed and single sheets. A versatile printer is capable of handling all these paper formats. The width of the paper also varies from 4 1/2 inches (mailing labels) to 8 1/2 inches (standard typewriter paper) to 15 3/4 inches (wide computer paper). Most printers can handle either up to 8 1/2 inch or full-width paper. The printing speed varies greatly by printer. The ink jet and laser printers produce pages of print in a few seconds. Most dot-matrix and daisy wheel printers print between 10 and 200 characters per second.

Obviously, the cost of the printer varies according to the capabilities of the printer. Some dot-matrix printers cost as little as $250, but the print produced is not letter quality, nor do they have underlining and sub or superscript capability. One brand which sells for approximately $400 and produces a letter quality dot-matrix print, as well as having a versatile repertoire of printing fonts and other capabilities, can handle both friction feed and traction or pin feed papers. Daisy wheel printers begin at about $500 for slow, letter quality printing, and increase to over $2,000 depending upon speed and capabilities. Ink jet and laser printers range between $2,000 and $15,000.

The interfaces between the input and output devices and the CPU are very important. Interfaces perform a variety of functions. In addition to the hardware interfaces built into the micro, a number of software interface enhancement programs (called utilities) are also available. Because of the differences in operating speeds of the CPU (hundreds of thousands of operations in a second) as opposed to the slower speed of a printer (10 to 200 characters per second), devices called "spoolers" provide temporary storage for output from the CPU until the printer can "catch up." Each type of input and output device requires an interface with the CPU.

Fortunately, the computer industry has standardized two interfaces for microcomputer use: The RS232-C Serial Interface and the Centronics Parallel Interface. A serial interface transmits and accepts information one bit at a time, while a parallel interface accepts more than one bit at a time depending upon the number of wires in the cable. For example, an 8-wire parallel interface could transmit and accept 8 bits of information at a time. Because of this, parallel interfaces are usually quicker than serial interfaces. However, the RS232 interface is much more universally used in microcomputers, and either comes as standard equipment on most computers, or may be purchased separately. Such an interface is required for communications with other data processing systems. Further, the bus or signal lines that connect the interface with the CPU have also been standardized (the S-100 bus being the most prevelant). Taking advantage of this standardization of busses, many microcomputers manufacturers have built in bus structures into the CPU boards into which special purpose boards or cards may be inserted. This

standardized plug-in bus structure is often called the "mother board." Through these mother boards, special language cards, graphics chips or voice synthesizer chips may be simply installed into the micro, greatly enhancing its capabilities and versatility. For example, it is now possible to buy a special plug in board for certain microcomputers which automatically allow the micro to run certain other brands of software.

Microcomputer Software[1]

As previously discussed, the microcomputer's ROM (Read Only Memory) contains a set of instructions that the microprocessor acted on immediately at startup (pushing the off-on switch). This obviously is not the only set of instructions used in the operation of a microcomputer. Taken together, the various sets of instructions comprise the "software" of a microcomputer system. Even the best equipment is rendered virtually useless without appropriate software.

Besides the ROM, the manufacturer of the micro also has to supply the user with a set of programmed instructions that give the microprocessor the necessary information to utilize the programs and data that are stored on the disk storage devices. These include a set of programs which: 1) give the microprocessor the necessary instructions on how to interact with the disk storage devices; and 2) give the user the capability of interacting with the disk storage devices. This software is called the Disk Operating System (DOS). All computers have an operating language, and all microcomputers have a DOS. Unfortunately, the DOS is not the same for all microcomputers. A disk which is formatted for one brand of micro will not run on another (unless the user has installed a special card on the mother board which enables it to do so) because the DOS is different.

The DOS typically consists of a set of programs which:

1. Tell the microprocessor how to obtain information from the storage device.

2. Enable the user to interact with the storage device by storing and retrieving programs or data from the storage device (such as a disk directory routine, a disk copy program and a program which checks how much storage room is left on the disk).

3. Contains a number of programs designed by the microcomputer manufacturer to facilitate the use of the microcomputer in general (such as a line editor, a higher language program and a machine language compiler).

Most disk operating systems have the same basic functions, but they may be called different names on different machines. For example, the program which lists all the files on a disk is may be called a "CAT" for catalog or a "DIR" for directory in MS DOS depending on the brand of microcomputer.

While the ROM gives the microcomputer start-up instructions, and the DOS tells the micro how to interact with the storage device, there must be a way for the user to tell the micro what data processing application is desired. These programs are the most important from the standpoint of users, but typically do not come with the microcomputer because the manufacturer cannot know what applications are most important to various users. There are three primary ways to obtain these

programs: 1) write them, 2) obtain general purpose software and adapt them to that specific application, or 3) buy commercially available software designed for that specific purpose.

Computer programs are written in special languages that are understood by the processor unit in the computer. As discussed previously, the central processing unit of the computer accomplishes its tasks by manipulating long series of "0" and "1" digits in the "Binary" language. When the machine is designed, other languages are built into the machine, either into the CPU circuitry itself or into the ROM. Typically, the higher level languages are "assembly" language and BASIC. The computer must translate these higher languages back into a series of 0's and 1's. This is where the operating speed of the micro becomes important.

These higher language programs are written in a form that the user may readily understand. However, simply being able to recognize the words "go to," "input" and "print" does not enable a person to program in that language. Programming requires a great deal of training and practice, and once learned is very time consuming and tedious work. As most school business administrators are trained in other skill areas, writing computer programs is not the most efficient use of their time, and should be left to technicians. Thus, if a school business administrator wants to perform an application on the microcomputer, he or she must either have the program written for the school district or buy a program that is already developed and adapt it to the district's needs.

Conventional wisdom in the microcomputer industry estimates that an efficient program that performs a valuable management task requires upwards of 5,000 to 10,000 man-hours of programming time to write. At 1985 prices of approximately $25.00 per hour of programming time, the average business software package costs the developer $100,000 to $250,000 and up. Thus, when the user has a software development firm write a customized software program according to specifications, they are essentially paying that developer for the time required to write and test a program. If the cost of developing that program cannot be shared by selling it to other users, it is usually prohibitively expensive to have that application package written.

This problem was well recognized in the late 1970s and early 1980s when school districts were using minicomputers that did not have commercially developed software readily available, and the districts had to have software written especially for them. This is one of the reasons why the use of microcomputers in school districts has flourished. Because the microcomputer does not cost as much as the mini or mainframe computers did, the more school district money is available to purchase software.

Software Programs and Packages

A viable option for school business administrators who cannot write programs or determine not to have it especially written for the district is to adapt software packages designed for general business purposes to the needs of the district. There are three primary types of general purpose software: word processors, electronic spreadsheets and data-base management packages. While it is beyond the scope of this chapter to discuss these packages in great detail, a brief discussion of each appears below.[4]

Word processors are used to facilitate the development and printing of all types of documents. They allow for many changes in the text of a document, and enable

the production of a final document much more rapidly than manual or typewriter based methods. No business office should be producing documents without some type of automated word processing system.

The availability of *electronic spreadsheet* software is probably the primary reason for widespread business use of microcomputers. In essence, anything that can be performed with a pencil, paper and hand-held calculator can be performed much more rapidly and virtually 100 percent error free using an electronic spreadsheet. The use of this software is limited only by the creativity and time constraints of the user. At present, there are thousands of applications in school business administration that are being performed through the use of electronic spreadsheets, as discussed later in this chapter. While some spreadsheets are better or more versatile than others, all have essentially the same features and perform the same functions. The recalculation, built in mathematical and statistical functions, advanced analysis and graphing capabilities, to name only a few features, make the electronic spreadsheet an invaluable tool and should be an integral component of any management information system in a school business office.

Data base management programs are the third general type of software package available on the microcomputer. These packages allow the user to input, store and retrieve large amounts of data in a structured fashion. Once entered, the data may be manipulated in a variety of ways and produced in a report format that is designed by the user. These packages have been used for the development of personnel management systems, fixed asset accounting systems and, in general, any application that requires the development and production of lists of data. Again, there are many uses for this type of software package in a school business operation, and no school district should be without one.

While the uses of word processors, electronic spreadsheets and data base management software packages are many, the main drawbacks to their use are that the user must: 1) learn how to use them efficiently, and 2) have the time and creativity to develop the application of interest. For example, one area of application for school business management is in the cost analysis of salary schedules. It may take an accomplished user of an electronic spreadsheet several working days to develop and test a spreadsheet that performs an analysis of a new salary schedule. There are, however, several commercially available software packages that are designed specifically for this purpose which yield a wide variety of useful statistics and handle a number of different formats for salary schedules. At a price of $250 to $500, these packages perform salary schedule cost analyses better than most "home made" electronic spreadsheets produced in a reasonable amount of time. The trade-off, of course, is whether the cost of the specific application package is lower than the cost of the time that it would require one to develop a comparable application on the electronic spreadsheet. If the cost of the commercial package is low, it would probably be cost-effective to buy a package rather than develop the application.

The problem with commercially available software is that the software development firms have not yet been willing to invest time and money in the development of an application package that has a limited market. These packages cost a great deal of money to develop and test, and a large number of sales must be anticipated before a company is willing to take the risk. Fortunately, as more microcomputers are sold to school business administrators, the more these software development firms are willing to write software which meets school districts' needs. Many of

these packages are cost-effective, and school business administrators are exploring their use.

Another constraint to the development of the commercially available software has been that microcomputers have not had the technical capability of handling the large data sets required for the major business operations of a school district, such as budgeting, accounting, payroll and personnel management. However, as the microcomputers gain in computing and storage capacity, the software development firms will begin to produce the applications packages for these major business areas. These packages will become cost effective to purchase.

Despite the fact the microcomputers have not been in use a long time, there are a large number of commercially available software programs that are useful in a school business operation, in addition to the word processors, electronic spreadsheets and data base management packages just discussed. Many of these contain specific programming features which will greatly reduce the amount of time it takes to learn and use these programs. The following is a list of features of "user-friendly" software packages that should be considered when buying software.

1. *Auto Boot* implies that the user simply has to take the disk on which the software resides, insert it into the disk drive, turn on the machine and the program automatically is loaded into the microcomputer and runs. This feature eliminates the need to know what language the program is written in which in turn determines the mode of booting.

2. *Menu Driven* software programs present a screen giving the user choices regarding the particular aspect of the program that they want to use. All the user has to do is to press the key on the keyboard of the number that lists their choice on the screen. This feature eliminates the need to know how the program operates or what keystrokes are needed to perform a particular operation of the software program.

3. *On-Screen Documentation* means that the set of instructions needed to operate the program may be shown on the screen. This eliminates the need to search through a manual to find the instructions needed. This also allows users to refresh themselves on the use of the program if the manual is unavailable.

4. *Help Screens* are usually one of the first options in a menu driven program. Typically, if you press the key for help, either an abbreviated discussion of the software program is given or a discussion of what the rest of the options on that particular menu are and the order in which they must be used is presented.

5. *Flexibility to Adapt to Various Equipment Configurations* is desirable for a number of reasons. A good software package should be adaptable to a wide range of equipment and should state what equipment is required on the outside of the package. For further protection against problems, the user should have the program demonstrated by a salesperson familiar with the package, and should ask what equipment is needed.

6. A good software package should give users the *Ability to Design* their own

reports. Quite often, the software package has reports designed to meet some preconceived concept. Unfortunately, these reports may not resemble anything that the user has been using previously, forcing users to change their mode of using the reports.

7. *Error Recovery* is important, especially for the novice user. Quite often the user may push the wrong key or not follow the required procedures for using the software. Some programs are unforgiving of mistakes of this nature, resulting in a loss of data. Error recovery means that even if an error is made by the user, the program will either not allow the error and wait until the user keys in the proper response, or will bring the user back to the point of operation in the program at which the error was committed.

8. *Multiple Points for Saving Data Files and Reports* is important because when manipulating data and files, many changes are made which the user may wish to save on the data disk for the future. Many programs, however, do not give the user the option of saving a data file or report until just before terminating use of the program. A good program will prompt the user to save a file at the point when changes are made.

9. An *Escape Key* gives the user a capability of correcting an operational mistake as soon as it occurs. For example, if a report is being printed that is not designed properly, pressing the "escape" key will stop the printing operation and allow the user to correct the mistake without having to wait for the entire report to be printed, thereby saving time, paper and energy.

10. A desirable feature of a good software program is the flexibility to *Use Either One or Two Disk Drives*. Some programs allow the user to use only one disk drive even though two drives are available, resulting in a lot of disk swapping and lost time.

11. *Alternative Print Modes* is a nice feature, especially in word processing and report generating programs that use dot matrix printers. Some programs allow the user to use bold and shadow printing, and/or to print in a variety of printing fonts such as italics and Old English lettering.

12. *Auto Dating of Reports* is a feature that is needed if a lot of reports are printed using the same format but at different times of the day or on consecutive days. Auto Dating programs will automatically print the day and the time on the report making it much easier to distinguish one report from another.

13. *Clear Documentation With Immediate Start Up Direction* is important, since most users want to immediately begin using their program as soon as possible.

14. A nice feature is to have *All Required Program Files on One Disk*. In the operation of many programs, one must load the Disk Operating System, which is on one disk, load the language compiler, load the program lan-

guage, and then the program, and then the data file before the program can be used. A good program, especially one with an auto boot, will have these files on one disk (or a hard disk or RAM Disk) which will greatly speed the operation of the program.

15. Quite often in the operation of a program, the user will not know what the program is doing at any given time, and it is not unusual for a program to be operating for several minutes without anything showing on the screen to indicate that it is working. A good program will always give the user a prompt, such as "The figures for the report are now being generated," so that the user always knows what is going on.

16. A *Hotline* or a phone number for the user to call anytime day or night when problems occur is available with many of the larger and more reputable software firms.

17. *Low or No Cost Access to Program Updates* is important because programs are constantly being updated with new features or having "bugs" in the program fixed. Many companies, however, charge the purchasers of earlier programs the full cost of any program updates they buy.

18. *Ability to Backup the Program Disk* is essential, especially when the program is used on a daily basis. The user should always make several working copies of the original program disk and use those in the day-to-day operation, storing the original in a safe place. However, many software companies do not allow their software to be backed up for fear that someone will copy the program and give it away. While such software piracy is rampant and is a major problem in the software industry, not being able to copy software is a major problem to the user if the original is lost or damaged.

19. In software packages that generate reports, a useful and time-saving feature is the *ability to pick files for reports*. Quite often, the user will find that a number of data files have been produced previously which need to be combined in a variety of ways to meet a particular need. However, many software packages are designed so that the user has to go through the whole procedure of calling up, changing, storing and then printing a report. A good program will allow users to simply select the names and order of the data files desired and then print a new report.

Of course, not all software programs will have all these features, but if a program is obtained which has as many of these features as possible, the user will be much more satisfied with the operation of that program, and the time required to get the job done will be greatly reduced.

Human Aspects of MIS

While hardware and software are important to a computer based MIS, the human aspects of the MIS are equally, if not more, important. The major facets of the

human component of MIS requiring attention include: 1) overcoming resistance to the implementation of an MIS, 2) training for efficient MIS usage, and 3) managing the MIS operation.

Overcoming Resistance to Implementation

Without proper consideration of the behavior of the people in the business office setting, the best technically designed system is likely to fail. As with most innovations, the introduction of a new MIS represents a threat to organizational relationships and psychological needs of the people in the office. There are a number of specific reasons for implementation resistance.

1. *Threat to status*. A supervisor may be downgraded below a technician in the organization.

2. *Threat to ego*. A key skilled clerical job is performed by an unskilled computer operator.

3. *Economic threat*. Fear of loss of a job.

4. *Job complexity*. A new microcomputer requires a great deal of new and technical knowledge, which has to be learned.

5. *Isolation*. The top manager feels he will be deprived of the "personal" information now gained when he is made dependent on computer output.

6. *Superior/Subordinate relationships change*. New information flows produce new balances between the superior and subordinate.

7. *Job ambiguity and loss control*. Planning and control is performed largely by the MIS except for special occasions that occur randomly.

8. *Time rigidity*. The total system requires "programmed" coordinated actions similar to a mass production assemble line.

9. *Interpersonal relationships changed*. Former informal work groups and working relationships are broken.

There are three actions that may be taken to reduce the perception of threat from one of the nine causes listed. First, a climate for change must be created by having the managers and clerical staff dissatisfied with the present system voice their concerns. This may be accomplished by holding a series of seminars focusing on what is wrong with the present system and methods for revision. Participants of the seminar should be left with a feeling that changes are needed and will be made, and that their views are being taken into account before any specific changes are made.

Second, effective agents for change must be developed within the organization. There are informal leaders within any organization to whom other members of the work group look for protection and security. These key actors must be identified and their support for the MIS must be gained.

Third, modify the organizational requirements as specified by the MIS to more closely fit existing arrangements, if such adaptations enhance the effectiveness of the MIS. The "required" organization is a mechanistic technical organizational design. Alternate organizational structures, which are not "technically" ideal may be selected, however, in order to achieve working relationships that are far more productive.

Training

Once the resistance has been overcome, and the MIS is in operation, two things must happen: the staff needs to be trained in its use, and the MIS needs to be managed on a day-to-day basis. The training that is required is dependent upon the type of MIS that is implemented. If the MIS is designed for the sole use of the manager as an extremely sophisticated desktop planning tool, the training required would most easily be accomplished by sending the single user to a training program at the local microcomputer dealership or college. However, if the MIS is designed for multiple uses by a wide variety of staff, the complexity of the required training is substantially increased.

There are many ways to obtain training. The first step in any training process is to read the manuals that come with the hardware and software. A second step is to read some of the trade periodicals which are readily available. The final step is to provide an in-service training program for the MIS staff. The following are some guidelines to follow in the preparation of an in-service training program.

1. Learn how to use the microcomputer first before applications. This includes: basic operating procedures of the systems components such as the CRT and printer; implementation of the DOS commands including library and backup procedures; basic maintenance routines for hardware and diskettes; and a clear understanding of the dynamic nature of working with a microcomputer "on-line."

2. Schedule training of software packages in order of operating priorities.

3. Do not expect all persons to become an expert in all aspects of the MIS. Have people learn only what is necessary to perform their tasks efficiently.

4. Standardize your software so that all persons doing the same kinds of tasks will be working with the same brand of software. For example, do not have three different kinds of word processors.

5. Isolate the staff from their normal activities during the training period, but provide the training during normal working hours.

6. Provide the staff with the documentation of the hardware/software that each person will be using. After the training period is over, urge them to use the reference materials when problems arise before asking for help from other staff members.

7. Remember that the only way to learn how to use a microcomputer is to sit down in front of one and start to use it. Efficiency seems to grow exponentially with experience.

8. Be patient.

The Management of the MIS

Once the MIS has been implemented and the staff trained in its use, the management procedures of the MIS day-to-day operations deserve some attention. Successful use of the MIS is dependent on an infrastructure or supporting system. The first step in establishing such a system is to specify a set of procedures to control how and by whom the MIS is to be used. This should include rules and decision standards for issues arising in every day use. Who may use the machines and for how long? For what purpose? What work takes priority? How are support resources to be allocated?

The second management task involves the provision of resources needed by computer users to solve problems of implementation and use. Complete documentation of hardware and software is necessary. In-house consultants should be readily available because going outside is too time-consuming and expensive. Encourage workers to help each other, share experiences and engage in group problem solving. This may result in some lost time initially, but the rapid gain in computer expertise will rapidly make up for this loss. Information should be shared vertically with management also. If encouraged and rewarded, management will discover problem areas and successes quickly enough to initiate timely action.

The third element in the support system is control and security. There are a number of security concerns: 1) maintaining security of sensitive information when the MIS is in use, 2) securing the hardware and software from their theft or vandalism, and 3) securing the MIS from accidental damage. The value of the information stored in files far exceeds the value of the hardware and software because hundreds of hours of staff time was invested in creating those files. Electronic storage media such as floppy and hard disks can be damaged by exposure to static electricity, eletromagnetic fields, x-rays, high temperatures, bending, scraping and finger prints. Simple backup procedures for files and operating instructions for all personnel that come into contact with the MIS will help avoid a catastrophic loss.

Security against theft or damage to the hardware requires both organizational support and physical resources. Users must be trained in the proper use of the equipment. The sugar content in a spilled can of soda can erode the electrical connections in the keyboard, bringing all operation of the MIS to a stop until the problem is resolved. A single static charge can wipe out files on a floppy disk. Theft and accidents can be avoided by establishing and enforcing simple but reliable procedures. Hardware and software manuals detail many of the most common problems and how to avoid them. Physical security for the MIS installation may require additional hardware purchases, such as special microcomputer work stations that may be bolted to the floor and locked after working hours. Placing floppy disks in locked file cabinets may be necessary.

Theft or misuse of information is an equally dangerous possibility. Procedures must be established for coding and protecting sensitive files, such as personnel data. Logs and signout rules for file users should be established. Where microcomputer systems are linked to mainframes, the problem of security extends to files maintained on the larger systems.

Finally, the manager of the MIS should ensure adequate supplies including printer paper, ribbons, print heads, daisy wheels, disks and fuses. The complete list of needed supplies depends on the specific work site, but might also include dust covers in dusty areas, voltage surge protectors and backup power supplies, disk drive cleaning kits, anti-static sprays, binders for output and documentation, disk storage containers and special purpose printer papers such as labels. The amount of supplies needed for computer operations typically exceeds expectations, so a reserve budget for these items is necessary.

The design of the operating environment of the MIS is as important as the design of the hardware and software aspects of the MIS, and the successful implementation and operation of the MIS is dependent on the people that use the system. The manager of the MIS must attend to these facets in order to gain the full benefit of the investment in the management information system.

Microcomputers and the School Business Administrator: Specific Applications

The microcomputer has the potential to revolutionize the way in which school business administrators do their job. While much of the impact of this revolution has not yet been felt, within the next five years the school business administrator's duties, responsibilities and functions will be different. Many of the time-consuming, day-to-day tasks will be computerized, greatly reducing or eliminating the time business administrators spend doing traditional tasks. With more time available, administrators will turn to tasks that they simply have not had the time for in the past. Yet even today, there are many uses of the micro in the school setting. The section below provides an overview of many of these applications.

Table 8:1. lists potential microcomputer applications in school districts. Many of these applications are administrative in nature. Until recently, the majority of these applications were not possible without a large "mainframe" computer. However, with the recent advances in memory storage capacity of microcomputers, all of these applications are possible for most school districts on a microcomputer. The ability to perform these tasks in-house eliminates many of the time delays of sending computer work to a centralized computer operation. This also allows school administrators to exercise more control over the information needed, reports generated and time deadlines to be met, not to mention cost considerations.

While the microcomputer equipment for accomplishing these tasks may be available, the actual programs needed to perform many of these tasks are still under development. It will take a few years for the software development industry to catch up with the advances in equipment technology. Nevertheless, there still are a great number of helpful applications.

Word processing is one of the first applications. Studies have shown that the use of a word processor instead of a typewriter will increase clerical productivity an average of 48 percent. Besides typing, the word processor may also be used for

bulk mailings, filling out preprinted forms and specialized printing. Printer enhancement programs for dot matrix printers allow the user to print text in over twenty printing head fonts, from Old English to Script to Ultra Modern Computer Type. Each of these fonts may be enlarged up to twenty times automatically. With this program, the user has a virtual print shop right in the office.

Microcomputers are also extremely useful in the development of reports and lists from a data base. The important consideration to remember is that once the data base is developed, any number of reports can be quickly generated and printed in any format the user wishes. For example, the user can create a report listing the names, addresses and telephone numbers of all students that have a school owned instrument within minutes.

Figures 8:1 and 8:2 illustrate typical reports that can be developed by school districts with microcomputer software. These are actual reports school districts have produced using electronic spreadsheet programs. Once these templates have been developed, the programs may be used year after year for the same application by simply inserting the updated data for the year of use. As the reports are updated and new data are inserted into the proper place on the electronic spread sheet, all the figures dependent upon the new figures are recalculated automatically. This results in hours and days of administrative and clerical time savings.

Figures 8:3 and 8:4 show two more electronic spread sheet applications, both concerned with school cash management. The first shows a cash flow that is used to determine the periods for school district borrowing and investing. Figure 8:4 displays a report showing a district's interest earnings on investments. This program calculates both the interest income due and the total interest earnings.

Table 8:1 Educational Uses of Microcomputers

Administration					
Student	**Finance**	**Personnel**	**Facilities**	**Library**	
Admissions Registration Scheduling Student Records Attendance Census Alumni Records Student Activities Student Health Student Placement Student Financial Aid	Accounts Receivable Planning Budget Development General Ledger Purchasing A/P Fund Raising Portfolio Analysis Fixed Asset Acctg.	SUN Teacher Assign. Payroll Personnel Systems	Security In-house Management Audio-Visual Library Vehicle Scheduling Maintenance Scheduling Equipment Inventory Supplies Inventory Food Service Housing Dormitories Scheduling & Utilization	Bibliographic Search Serials Periodicals Circulation Control Cataloging Acquisitions	

Instruction					Research	Public Service
Guidance & Counseling	**CAT**	**CMI**	**Computer Education**	**Student Computing**	**Research**	**Community Support**
Student Counseling Career Guidance	Test Preparation Test Scoring & Analysis Diagnosis & Prescription	Drill & Practice Tutorial/Dialogue	Literacy/Concepts Operations Training Programming Training Computer Science	Student Programming Application Packages	Statistical Analysis Mathematical Analysis Non-Numeric Analysis Project Admin. Simulation Data Acq/ Reduction Process Control Graphics Info. Retrieval Text Editing	Extension Services Continuing Edu. Recreational Activities Vocational Edu. Adult Education Museums & Galleries Cultural Events

General Fund
Budget Status Report
Detailed Statement Of Revenues

Local Sources	Original Budget	Anticip. Revenues	Actual To Date	Balance
Real Property Tax				
A1001 Real Property Tax	2686606	2683070	2683070	0
A1090 Interest-Penalties	0	10755	10755	0
A1099 Total Tax Items	2686606	2693825	2693825	0
Charges For Services				
A1310 Day Sch Tuition/Ind	0	1200	750	450
A1315 Adult Ed Tuition	500	480	335	145
A1330 Textbook Charges	0	0	0	0
A1335 Other Student Charges	200	350	180	170
A1410 Admissions	2000	3294	3294	0
A1489 Other Charges/Ind	500	400	170	230
A2229 Other Gen. Serv/Govt	0	0	0	0
A2230 Day Sch Tuition	5000	5250	1500	3750
A2235 Services For Boces	0	1100	0	1100
A2304 Transp. Other Dists.	0	0	0	0
A2308 Transp. Boces	0	0	0	0
A2350 Youth Rec. Srvs/Govt	1000	1957	387	1570
A2389 Misc Rev Other Govt	1000	746	746	0
A2399 Total Charges/Svcs	10200	14777	7362	7415
Use Of Money-Property				
A2401 Interest & Earnings	60000	90000	72668	17332
A2410 Rental Real Property	5000	4000	3000	1000
A2412 Rental Real Prop. Govt	0	2250	2250	0
A2413 Rental Real Prop. Boces	2000	3200	2240	960
A2414 Rental Equip/Ind	200	200	168	32
A2440 Rental Other	0	0	0	0
A2450 Commissions	250	100	48	52
A2499 Total Use Money	67450	99750	80374	19376
Sale Of Property And Compensation — Loss				
A2650 Sale Of Scrap And Excess Materials	0	0		0
A2666 Sale Of Transportation Equipment	1677	2148	2148	0
A2680 Insurance Recovery	0	2654	2654	0
A2690 Other Compensation For Loss	200	88	88	0
A2699 Total Sale Of Property And Loss	1877	4890	4890	0
Miscellaneous:				
A2701 Refund Of Prior Year Exp. — Boces	1200	49278	49278	0
A2705 Gifts & Donations	0	2418	2418	0

Figure 8:1 Sample Financial Report Generated with Microcomputer Software

Tentative Tax Rates
Current Years

Town	Av	Eq. Rate	Fv	Prop.	Tax/Fv	$1000/Av	Check	Prior Yr.	Change
Cairo	17429719	1903	91590746	582142505	1536949.36	88.18	1536935.19	89.86	-1.68
Durham	8363433	1562	53543105	340315137	898486.41	107.43	898483.61	109.12	-1.69
Athens	430766	2086	2065034	013125169	34652.55	80.44	34652.54	82.32	-1.88
Catskill	707456	2426	2916142	018534735	48934.67	69.17	48934.02	70.25	-1.08
Coxsackie	63683	1747	364528	002316907	6117.01	96.05	6116.94	97.03	-0.98
Greenville	724003	141	5134773	032636153	86164.67	119.01	86164.32	120.22	-1.21
Conesville	22251	0503	442366	002811638	7423.18	333.61	7423.16	338.07	-4.46
Rens'ville	63349	0496	1277198	008117755	21432.17	338.32	21432.17	343.51	-5.19
Total	27804660		157333892	1	2640160		2640141.95		
					2640160.00		-18.05		
Budget	5063043								
Fund Balance	320539								
Revenues	2102344								
Tax Levy	2640160								

Figure 8:2 Sample Report — Produced by Microcomputer Software

CASH FLOW
CURRENT YEAR

DATE MONTH	DAY	EXPENDITURES TYPE	AMOUNT	REVENUES TYPE	AMOUNT	BALANC
SEPTEMBER						
	14	CASH				738938
	15			AID	33880	772818
	15	BC/BS	18000			754818
	15	DENTAL	1876			752942
	15	SOC. SEC.	15588			737354
	15	REPO-9/21	160000			577354
	15	REPO-9/28	300000			277354
	15	CD-12/14	140000			137354
	15	CD-12/23	200000			-62646
	18			CD-8/18	150000	87354
	18	PAYROLL #6	310000			-222646
	18			REPO-9/9	106000	-116646
	21			REPO-9/15	160000	43334
	25	WARRANT #2	300000			-256646
	25			TAXES	566000	309354
	25	CD-10/5	250000			59354
	25	REPO-10/5	200000			-140646
	25	CD-12/23	100000			-240646
	28			REPO-9/15	300000	59354
	28	BUS BONDS	26400	CD-5/28	150000	182954
	28			REF.	40000	222954

Figure 8:3 Sample Reported Generated by an Electronic Spreadsheet Program.

INVESTMENT SCHEDULE
July 1, Current - June 30, Current Year

Date:

DATE INV.	DATE DUE	SOURCE OF FUNDS	BANK DEP.	PRINCIPAL AMOUNT	INTEREST RATE	NO. OF DAYS	INTEREST INCOME	TOTAL INV. INCOME
2/18	9/18	ST. AID CHEN		150000	.175	37	2697.92	2697.92
5/28	7/13	ST. AID S.T.		150000	.172	46	3296.67	5994.58
5/28	7/27	ST. AID S.T.		110000	.172	60	3153.33	9147.92
6/16	8/10	ST. AID S.T.		100000	.1675	55	2559.03	11706.94
6/16	8/21	ST. AID S.T.		100000	.1655	66	3034.17	14741.11
6/16	8/27	ST. AID S.T.		386000	.1655	72	12776.60	27517.71
8/26	9/4	ST. AID S.T.		100000	.1725	7	333.42	27853.13
8/28	9/14	ST. AID S.T.		200000	.165	17	1538.33	29411.46
9/9	9/18	ST. AID S.T.		106000	.16875	9	447.19	29858.65
9/15	9/21	TAXES S.T.		160000	.155	6	413.33	30271.98
9/15	9/28	TAXES S.T.		300000	.16	13	1733.33	32005.32
9/15	12/14	ST. AID L.F.		140000	.1625	90	5687.50	37692.82
9/15	12/23	ST. AID L.F.		200000	.1625	99	8957.50	46630.32
9/25	10/5	TAXES S.T.		200000	.1415	10	786.11	47416.43
9/25	10/30	TAXES S.T.		250000	.153	33	3718.75	51133.18
9/25	12/23	TAXES S.T.		100000	153	89	3782.50	54917.68

Figure 8:4 Sample Report Generated By An Electronic Spreadsheet Program.

While all the applications to this point have been performed by electronic spread sheet programs, Figure 8:5 displays a report that was generated from a commercially developed software package which is designed to generate new salary schedules and produce cost outs of these salary schedules. The user must input initially a scattergram of FTE employees in a base year and the salary schedule in the base. The program then allows the user to update the scattergram and increment it one year, and to generate a new salary schedule by increasing the base year salary schedule by a percent or dollar amount for any step or column. It then allows the user to prepare a number of reports, one of which is shown in Figure 8:5. The advantage of this type of program, which handles both salaried and hourly employees, is that it is versatile and fast. The purchase of such a program is generally cost effective in comparison to electronic spreadsheet programs with similar capabilities.

SCHOOL DISTRICT
NEW SALARY COST-OUT

	B	B + 30	B + 40 M	B + 70 M + 30	B + 80 M + 40	TOTALS
STEP 1	0	0	0	0	0	0
STEP 2	20100	0	30000	62400	16600	129100
STEP 3	13600	29400	24320	79000	0	146320
STEP 4	112800	60800	65940	40900	230100	518540
TOTALS (NEW SALARIES TIMES ADJUSTED SCATTERGRAM)	146500	90200	120260	190300	246700	793960
TOTALS (BASE SALARIES TIMES BASE SCATTERGRAM)	130400	81400	108680	172800	224400	717680
DIFFERENCES (INCREASE INCLUDING INCREMENT)	16100	8800	11580	17500	22300	76280
INCRMT ONLY	1100	400	960	2200	1600	6260

EMPLOYEE SCATTERGRAM SUMMARY	INCREASES PER FTE — EXCLUDING STEP INCREMENT	INCLUDING STEP INCREMENT	AVERAGE SALARY PER FTE
FOR 27.3 EMPLOYEES PREVIOUSLY NOT ON TOP STEP	1301 (9.18%)	1530 (10.98%)	15467
FOR 23.0 EMPLOYEES PREVIOUSLY ON TOP STEP	1500 (10.23%)	1500 (10.23%)	16161
FOR 50.3 EMPLOYEES (ALL INCLUSIVE)	1392 (9.6 %)	1517 (10.63%)	15784

Figure 8:5 Sample of Report Generated By Commercially-developed Software Package.

Figure 8:6 demonstrates a use of microcomputers for transportation management using an electronic spreadsheet program. The report uses bus maintenance information to perform a monthly bus cost analysis. There are also numerous bus routing and scheduling programs which may be used to prepare school bus routes and schedules that reduce bus ride times, miles traveled and total transportation costs.

TRANSPORTATION DEPARTMENT
MONTHLY BUS COST ANALYSIS

DATE: # BUSES: 9

BUS #	MILES	GAS	OIL	TIRES	REPAIRS	TOTAL	COST/MI
7	387	77.80	12.03	0.00	45.53	135.36	0.35
8	478	86.50	1.57	174.87	219.89	484.83	1.01
11	423	81.50	17.50	0.00	73.89	172.89	0.41
12	603	106.90	2.59	435.50	16.03	561.42	0.93
13	501	90.75	0.00	0.00	88.87	189.62	0.38
15	399	79.03	15.50	0.00	23.10	117.63	0.29
21	457	82.03	3.80	123.80	0.00	209.63	0.46
23	576	95.90	0.00	0.00	179.50	275.40	0.48
24	513	93.78	13.80	0.00	34.90	142.48	0.28
TOTALS	4337	796.19	66.79	734.57	691.71	2289.26	

MONTHLY AVERAGE COST PER MILE: 0.51

Figure 8:6 Sample of Transportation Department's Report Using Electronic Spreadsheet Software.

Figure 8:7 shows a report prepared using an electronic spreadsheet program for the analysis of food service costs, and a profit and loss statement for the food service program over a period of eight months.

SCHOOL LUNCH OPERATION
STATEMENT OF OPERATIONS FOR THE PERIOD
JULY 1, CURRENT YEAR - MARCH 31, CURRENT YEAR

	MARCH			
SALES				
SALES OF TYPE "A" LUNCH	12665.15		70680.28	
OTHER CAFETERIA SALES	9449.72		56520.97	
TOTAL SALES		$ 22114.87		$ 127201
VALUE OF FOOD SOLD	24064.50			
BEGINNING INVENTORY	12088.65			
+ PURCHASES OF FOOD	36153.15			
TOT GOODS AV FOR SALE	20581.00			
-ENDING INVENTORY		$ 15572.15	15701.01	
VALUE OF FOOD SOLD		$ 6542.72	82329.83	
GROSS PROFIT			98030.92	
			20581.00	
				$ 77449
OPERATING EXPENSES				$ 49751
SALARIES	8219.29			
HEALTH INSURANCE	402.02			
SOCIAL SECURITY	322.67			
EMPLOYEE'S RETIREMENT	430.00			
SUPPLIES AND OTHER	1138.08			
WAREHOUSING COSTS	120.00			
MACHINE RENTAL & EQUIP	579.07			
TOT OPERATIONS EXP		$ 11211.13		$ 73360
NET LOSS FROM OPER		$ 4668.41		$ 23608
OTHER INCOME	0.00			
MISCELLANEOUS	124.71			
INTEREST	0.00			
REFUND — PRIOR YEAR'S EXP	5499.33			
STATE AID		$ 5624.04		$ 30079
TOTAL OTHER INCOME				
NET PROFIT		$ 955.63		$ 6470

Figure 8:7 Sample Report Generated By Microcomputer Software Concerning Food Service.

Summary

This chapter described why and how a management information system is such an important component of any educational organization. Emphasis was placed on a microcomputer-based MIS because of the technologial and operational advantages micros now bring to MIS. The discussion stressed not only the hardware and software applications, but also the importance of human aspects considerations of MIS. Finally, with the presentation of specific examples of applications of a microcomputer-based MIS, the chapter demonstrated the range of use and potential for increasing efficiency and cost-effectiveness of school district business management operations.

Notes

1. Much of the material in this section has been adapted from: Murdick, R.G., and Ross, J.E., *Information Systems For Modern Management*, 2nd Edition, Englewood Cliffs, N.J., Prentice-Hall, Inc., 1975.

2. See also, *Administrative Uses For Microcomputers, Volume 2: Hardware*, ed. F.L. Dembowski (The Association of School Business Officials International, 1984).

3. See also, *Administrative Uses for Microcomputers, Volume 1: Software*, ed. F.L. Dembowski (The Association of School Business Officials International, 1983).

4. See also, *Administrative Uses for Microcomputers, Volume 3: Word Processing and Office Automation*, ed. F.L. Dembowski (The Association of School Business Officials International, 1984).